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VERIFIED LITERAL ENGLISH TRANSLATION OF FOREIGN PRIORITY APPLICATION

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Verification of a Translation

I, the below named translator, hereby declare that:

My name and post office address are as stated below; that I am knowledgeable in the English language and in the German language, and that I believe the English translation of the attached document titled "Method and apparatus for loading a fibrous stock suspension" is a true and complete translation.

I hereby declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true, and further that all these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statement may jeopardize the validity of any application made thereon.

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Krista Conover

Krista Conover
(Full name of translator)

Post office address: Krista Conover
9937 Wares Wharf Circle
Glen Allen, VA 23060

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Method and apparatus for loading a fibrous stock suspension

The invention relates to a method for loading of a fibrous stock suspension with calcium carbonate.

Several methods for loading chemical pulp fibers with calcium carbonate are already known. A method is described in US 6,413,365 where the fibrous material is transported via a supply line together with calcium oxide and/or calcium hydroxide which are contained in said suspension. From there, the fibrous stock suspension is transported into a rotating distribution device. A reaction gas is fed in a ring shaped pattern into the fibrous stock suspension; this causes formation of calcium carbonate crystals in the fibrous suspension. The calcium carbonate crystals are distributed in the fibrous stock suspension through the rotating distributor device. This process is known as Fiber Loading Process.

A method for loading a fibrous stock suspension is described in DE 100 33 978 A1 whereby a medium which contains calcium oxide and/or calcium hydroxide, and pure carbon dioxide or a carbon dioxide containing medium are added to the fibrous stock suspension. According to US 2002/0088566 A1 a combustion process is utilized in order to produce carbon dioxide, whereby said combustion process is process linked with the device for the production of the fibrous stock suspension. A method for loading a fibrous stock suspension is known from DE 101 20 637 A1 whereby the carbon dioxide is produced from the waste-gas of a fuel or by lime burning. The carbon dioxide has a percentage purity of between 65 and 99% and is contained, for example in the waste gas of a power station, a combustion motor, a boiler or a device for direct burning of fossil fuel.

It is the objective of the current invention to further improve a method of the type referred to at the beginning.

In accordance with the current invention this objective is met by a method comprising the following process steps:

- Feeding of calcium hydroxide in liquid or dry form, or of calcium oxide into the fibrous stock suspension,
- Feeding of a flue gas which contains carbon dioxide into the fibrous stock suspension,
- Precipitation of calcium carbonate through the carbon dioxide which is contained in the flue gas and
- Removal of the superfluous flue gas.

The current invention describes a method for the production of fiber loaded precipitated calcium carbonate (FLPCC) and to simultaneously undergo a refining process, whereby the fiber raw material that is to be loaded may consist of recycling paper, DIP (deinked paper), secondary fibers, bleached or unbleached pulp, mechanical pulp, bleached or unbleached sulfate pulp, broke, linen, cotton, and/or hemp fibers (predominantly cigarette paper) and/or any fibrous raw material that can be utilized on a paper machine, irrespective of whether or not the end product contains a filler that was produced by a precipitation process in batch reactors or by a refining process, or whether talcum, titanium dioxide (TiO_2), silicon, etc. are used. The refining process is also referred to as GCC process (GCC = ground calcium carbonate).

When a fibrous stock suspension is processed with the fiber loading technology a completely new product for application in paper production results, with new and improved characteristics compared to a product according to the current state of the art. The fiber loading technology permits precipitation of a filler - especially calcium

carbonate - that is uniformly distributed and adhered to, in and between the fibers directly in the stock preparation of a paper mill. It also allows the treated fibrous stock to undergo a refining treatment in a refiner simultaneously with the precipitation process.

The process for the production of precipitated calcium carbonate with simultaneous refining with the assistance of the fiber loading combination process occurs according to a process known in the art, whereby reference is made also to DE 101 07 448 A1, DE 101 13 998 A1 and US 6 413 365 B1 in addition to the publications referred to at the beginning.

In accordance with the FLPCC combination process described under this invention the filler material utilized according to the current state of the art is replaced with the filler material produced according to the fiber loading combination process technology. The range of application of the filler produced with the fiber loading combination process technology extends to applications within the paper production of all paper grades, including cigarette papers, filter papers, kraft sack paper grades and cardboard and packaging papers that have a filler content of between 1 and 60% and /or a white liner having a filler content of between 1 and 60%. The loaded and produced paper grades can be produced on a paper machine from a recycling paper, deinked paper (DIP), secondary fibers, bleached or unbleached pulp, mechanical pulp, bleached or unbleached sulfate pulp, broke, linen, cotton, and/or hemp fibers (predominantly for cigarette paper) and/or any paper raw material, irrespective of whether or not the end product contains a filler.

Fibrous stock produced according to the fiber loading combination process technology generally possesses a superior dewatering characteristic compared to a fibrous stock produced according to another method; the improvement in the dewatering capacity is between 5 to 100 ml CSF or 0.2 to 15° SR, depending upon the required freeness. The stock or pulp produced according to the fiber loading process further possesses a lower

water retention value of 2 to 25%, depending upon the raw material that is used in production. This permits a more effective production of various paper grades, for example FL (FL = fiber loaded) copy and printing paper of all types, FL coating paper of all types, FL news print of all types and FL cigarette paper of all types, FL B&P paper of all types, FL kraft sack paper of all types and FL filter paper, since the water in the stock suspension can be removed faster. The stock therefore dries accordingly faster.

In the instance of FL cigarette paper, FL B&P paper, FL kraft sack paper and FL filter paper which do not require fillers, the loose filler can be removed by means of an additionally provided washing process prior to the refining process, following the refining process or after running through the headbox chest or prior to feeding into the paper machine. This applies to the filler that is not deposited in or on the fibers and can be washed out accordingly. The fibers themselves still contain filler, inside and out so that the positive effects of the fiber loading technology can be taken advantage of.

The fiber loading technology may be utilized prior to or after the refining process, depending on what requirements are put upon the end product.

Compared to the current state of the art, a higher freeness value can be achieved with the fiber loading combination technology, since up to 50% of refining energy can be saved; this has an especially positive influence with all the paper grades which pass through a refining process during their production, or which possess a very high freeness value, for example FL-cigarette papers, FL B&P papers, FL kraft sack papers and FL filter papers. In particular, these are FL cigarette papers having 100 to 25 CSF or 68 to 90° SR, FL B&P papers having 600 to 50 CSF or 20 to 80° SR, FL sack papers having 600 to 425 CSF or 20 to 30° SR and FL filter papers having 600 to 350 CSF or 20 to 35° SR.

The high mechanical strengths in the end product which are achieved through the high freeness value positively affect the production of FL cigarette papers, FL B&P papers, FL sack papers and FL filter papers since, due to process based mechanical loads in the various section of the paper machine, such as the press section, the dryer section and in the area where the web is wound, the produced intermediate product and the end product which is to be produced bears a high mechanical load due to utilization of winders, rewinders and converting machinery. Great mechanical stresses occur on the paper, especially in the production of cigarette paper, which are also partially caused by the low basis weight and the utilization of winders.

More effective drying to a residual moisture content of 1 to 20% permits an increase in efficiency for all paper grades. A higher water retention capacity, i.e. 1 to 25% results in a positive influence upon remoistening which is lower in the manufacturing process, as well as upon the printability of the produced web. An additional advantage for all paper grades is the greater brightness or the higher optical values with around 15 or more lightness points, which is to be emphasized in the production of all grades of paper and cardboard, with or without white liner. By using the fiber loading technology the optical values – for example in cigarette papers – are also improved by up to 15 lightness points when using for example deinking water.

An additional advantage of fiber loading with the above referenced paper grades is found in that for special applications calendering is provided and in doing so the so-called blackening due to deposits of FL particles in, around and on the fibers is suppressed or eliminated through utilization of the fiber loading process.

By utilizing flue gas the carbon dioxide emissions produced by a paper factory can be reduced by utilizing the carbon dioxide that is contained in the flue gas for the fiber loading process. An additional advantage is that by utilizing the carbon dioxide that is

contained in the flue gas transportation and storage of liquid carbon dioxide can be saved.

Advantageous design forms of the current invention can be seen in the sub-claims, the description and the drawing.

The flue gas which is being used in accordance with an inventive method has – for example – a carbon dioxide content of between 2 and 30%. The flue gas can be cleaned for example in a scrubber prior to introducing it into the fiber loading process, as described in DE 101 20 637 A1 [sections 0010 – 0011, wash tower 14 in the only drawing and associated description].

It is advantageous if a refining energy in the range of between 0.1 and 300 kWh per ton of dry fiber stock is applied during loading of the fibrous stock suspension with calcium carbonate. Loading and refining would preferably be conducted in separate and independent process steps in one device.

In accordance with one design form of the current invention aqueous fibrous stock material, especially aqueous fiber stock having a consistency of 0.1 to 20%, preferably between 2 and 8% is used as primary raw material

In accordance with the current invention calcium hydroxide is mixed as the preferred filler into the aqueous fiber stock material, especially into the fiber stock, whereby this has a solids content of between 0.01 and 60%. In accordance with the current invention utilization of a source material other than calcium hydroxide or calcium oxide for formation of the filler is also feasible.

The calcium hydroxide is added through a static mixer or an intermediate tank. The

carbon dioxide is preferably added into a moist fibrous stock suspension having a preferred consistency of 0.1 to 60%, according to the reaction parameters. Calcium carbonate is precipitated in a carbon dioxide gaseous atmosphere.

In accordance with the current invention the refining process is carried out simultaneously with the fiber loading process in an apparatus – the crystallizer; a refining energy in the range between 0.1 and 300 kWh/ton dry fiber stock is applied; a short reaction time of the calcium hydroxide with the carbon dioxide is important in this context. The energy supply or heat volume, or heating of the fibrous suspension for the production of crystals in various forms is important for the invention.

Depending upon application of the respective reaction machine, aqueous fibrous stock with a fiber content of between 0.01 and 60% is used as primary raw material.

An advantageous embodiment of the method provides that a static mixer, a refiner, a disperger and/or a fluffer FLPCC reactor are utilized as a reactor, whereby the fibrous stock content, especially the fiber content is between 0.01 and 15% in the instance of a static mixer; at between 2 and 8% in the instance of a refiner (low consistency refining) and between 20 and 35% (high consistency refining), and in the instance of a disperger between 2 and 40%, and 15 and 60% in the instance of a fluffer-FLPCC-reactor.

The current invention provides that the dilution water is supplied prior to, during or after the addition of carbon dioxide or calcium hydroxide or calcium oxide. Calcium carbonate precipitates when adding carbon dioxide into a calcium hydroxide solution or suspension. Conversely, the precipitative reaction also occurs, when calcium hydroxide is added to water under a carbon dioxide atmosphere. Dilution water may be added prior to, during or after the addition of carbon dioxide or calcium hydroxide.

An expenditure of energy of between 0.3 and 8 kWh/t, especially between 0.5 and 4 kWh/t is preferably used for the precipitation reaction when no refiner is used.

Likewise it can be provided that the process temperature is between -15 °C and 120 °C, especially between 20 and 90 °C.

According to the current invention rhombohedral, scalenohedron and spherical crystals can be formed.

Advantageously, the crystals measure between 0.05 and 5 μm, especially between 0.3 and 2.5 μm. Static and/or moving, especially rotating mixing elements may be utilized. The process is preferably carried out in a pressure range of between 0 and 15 bar, especially between 0 and 6 bar. The pH value is preferably between 6 and 10, especially between 6.5 and 8.5. The reaction time is advantageously between 0.05 seconds and 1 minute, especially between 0.05 seconds and 10 seconds.

The current invention relates to a device which comprises machines for loading the fibrous stock suspension with calcium carbonate. These are supplied with flue gas containing carbon dioxide. The machines are followed by a deaeration unit for the removal of superfluous gas. The configuration of the machinery is basically known from the documentation cited above.

A further advancement of the device provides that the flue gas from an incineration plant can be supplied especially to a gas motor or gas turbine.

The deaeration unit preferably comprises a chest with an agitator, a pressure screen, a deaeration pump, a cyclone, a cleaner and/or a deculator.

A further development of the invention is advantageous whereby an intermediate tank is installed after the deaeration unit, viewed in fiber stock flow direction.

The current invention is described in further detail below, citing a design example and with the assistance of the only drawing. This illustrates a schematic view of an apparatus for loading of a fibrous stock suspension.

A fibrous stock suspension 1 (figure) is supplied to an arrangement 2 of machinery for the fiber loading process which is not illustrated in detail here. In addition, flue gas 3 is also supplied to the arrangement 2 from a storage container 4 via a gas pump 5. The flue gas may, for example originate from a power station, an incineration device, a combustion motor, a boiler, or similar device.

The fibrous stock suspension 1 which has absorbed carbon dioxide from the flue gas 3 is now transported from the arrangement 2 to a deaeration device 6 where the carbon dioxide which was not absorbed by said fibrous stock suspension and the non-usable residual gas are again removed. The fibrous stock suspension is subsequently transported to an intermediate tank 7. The purpose of the intermediate tank 7 is for example to store the fibrous stock suspension 1 before it is transported on to a head box in a paper machine, or to another machine for the production of a fiber web.